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Title:	Slides for upcoming inter-laboratory round robin discussions
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Intended for:	discussion/presentation of results obtained at multiple participating laboratories of a recent inter-laboratory measurement round robins
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Slides for upcoming inter-laboratory round robin discussions

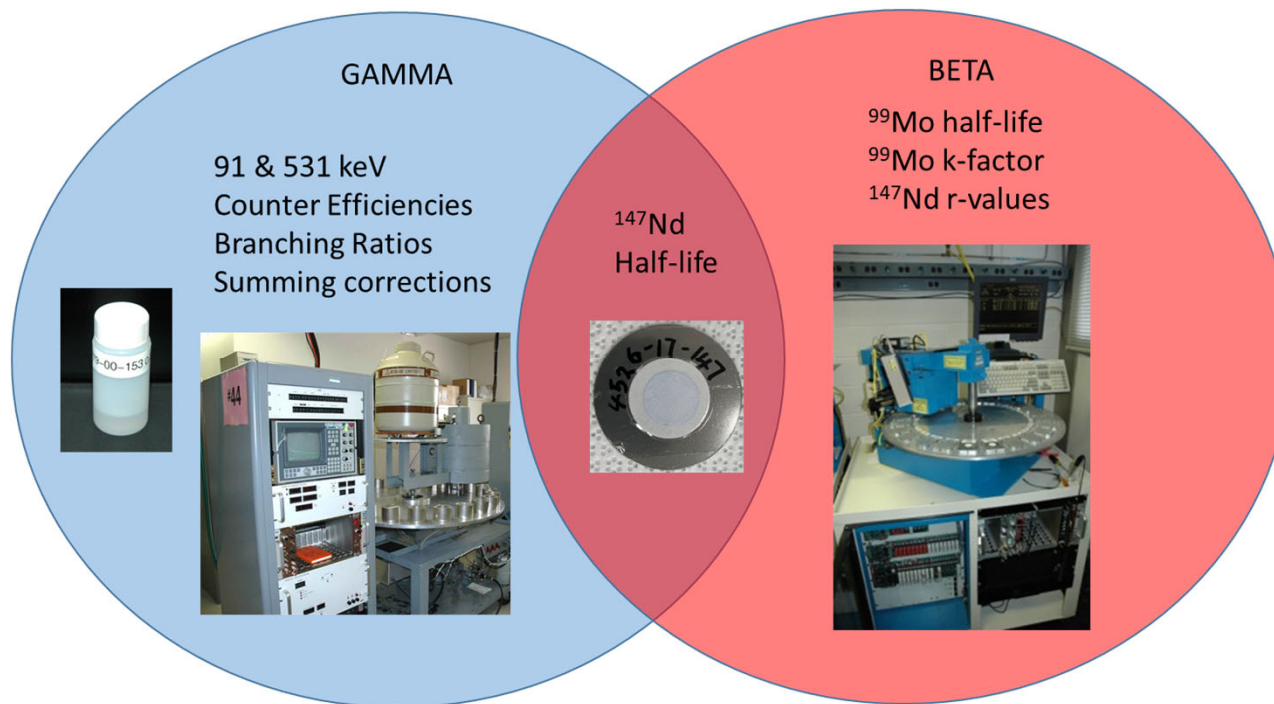
Iain May and Susan Hanson

^{147}Nd Results – LANL

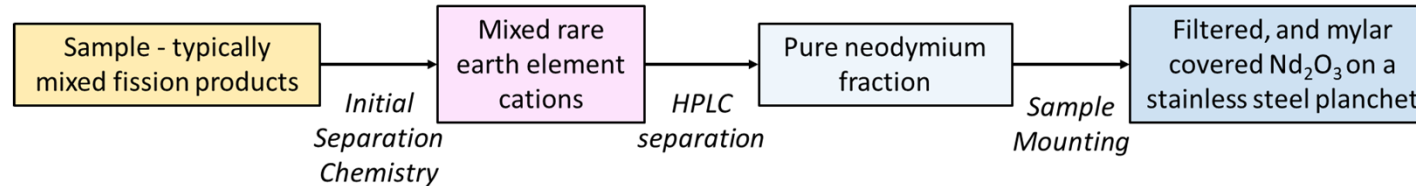
***M. Dembowski, A.J. Gaunt, I. May & N.C. Smythe (Radiochemistry) and
M.R. James, C.A. Lance, R.J. Rendon, J.R. Romero (Counting)***

Method	dpm/gA	± %
Solution gamma	1.23E6	2.4
Separated gamma	1.26E6	2.5
Separated beta (no absorber)	1.26E6	2.4
Separated beta (absorber)	1.25E6	2.8

Gamma-ray spectrometry and beta counting



Beta Counting – Radiochemistry and Counting Methodology

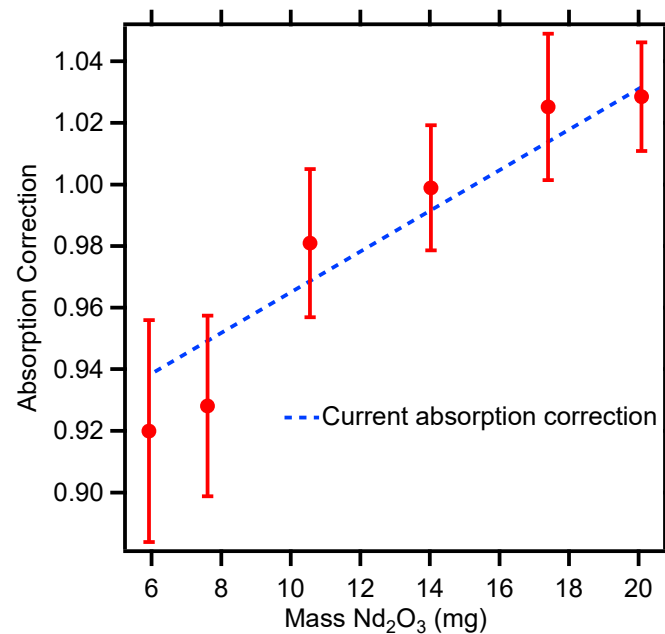
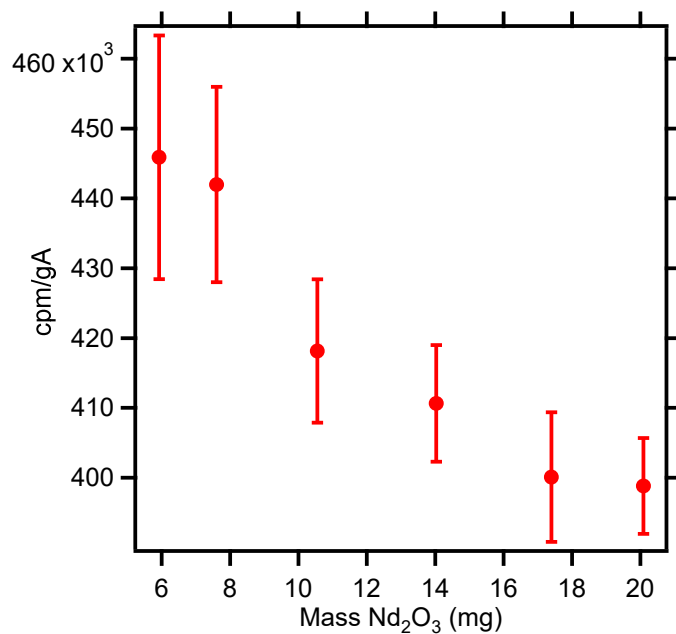


¹⁴⁷Nd 'r' values generated with & without aluminum absorber (without & with ¹⁴⁷Pm)

$$^{147}\text{Nd } r = \frac{^{147}\text{Nd cpm } (^{235}\text{U} - \text{thermal})}{^{99}\text{Mo cpm } (^{235}\text{U} - \text{thermal})}$$

$$^{147}\text{Nd } K - \text{factor (atoms/cpm)} = \frac{^{99}\text{Mo } K - \text{factor (fissions/cpm)}}{^{147}\text{Nd } r(^{235}\text{U} - \text{thermal})} \times ^{147}\text{Nd } \text{FY}(^{235}\text{U} - \text{thermal})$$

Absorption Correction Measurements Good Agreement with Current Correction Equation

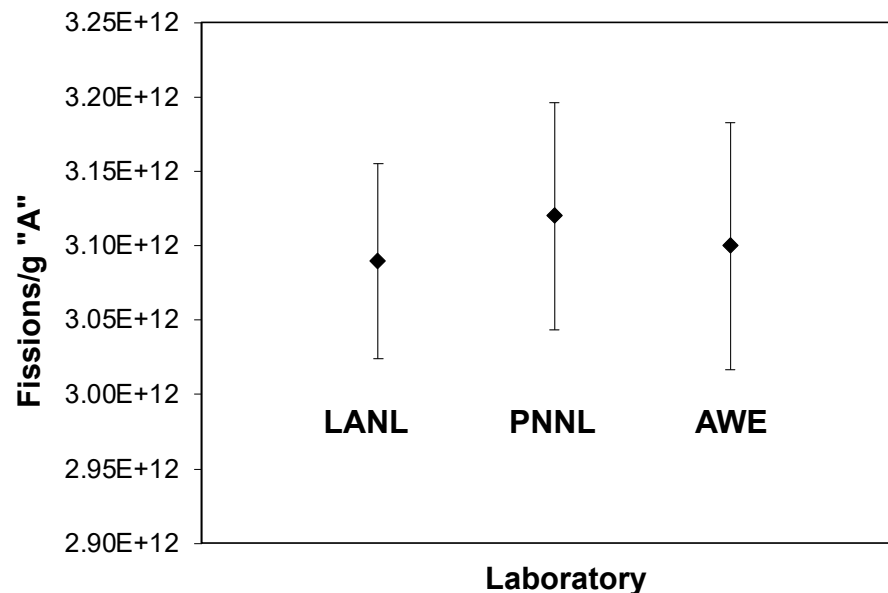


Main Findings

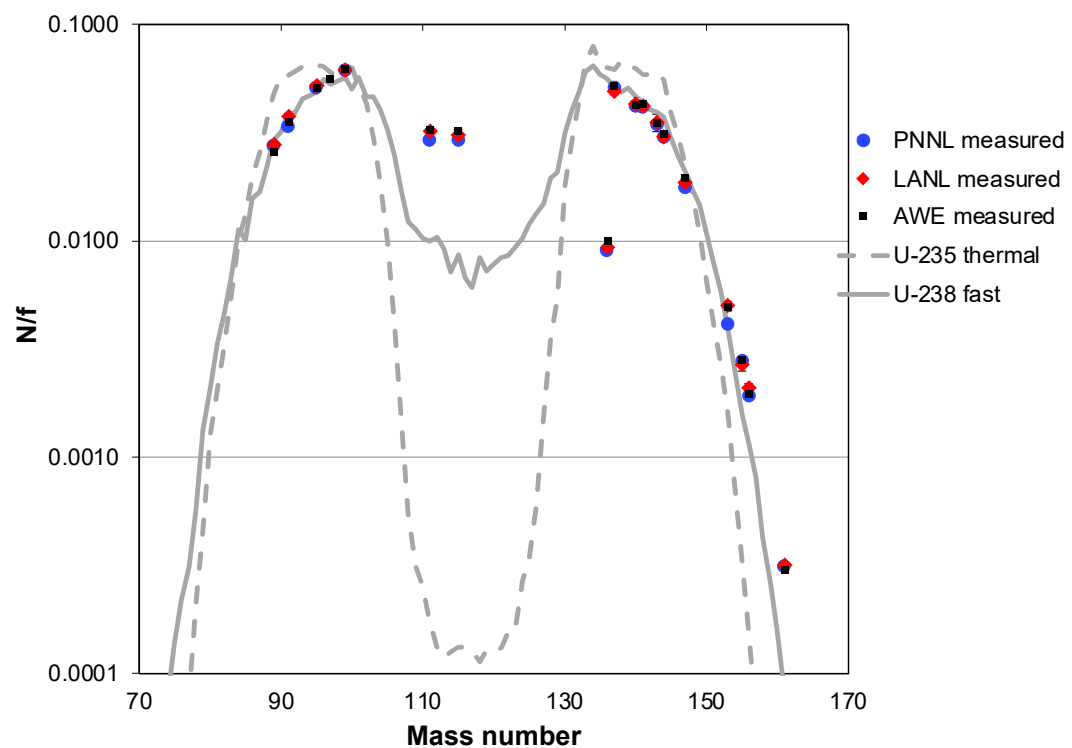
- Beta counting k-factor methodology used to determine activity/atoms
 - Both with/without an aluminum absorber (without/with weak beta emitting ^{147}Pm)
- Gamma-ray spectrometry measurements in good agreement with beta measurements
- Gravimetric yielding is the biggest contributor to the separated sample uncertainty budget
 - If lower uncertainties required chemical procedures can be developed to increase final masses

Total fissions per gram “A” measured at each laboratory

- LANL = $3.09\text{E}12 \pm 2.12\%$ (Mo-99 beta)
- PNNL = $3.12\text{E}12 \pm 2.44\%$ (Mo-99 gamma whole A)
- AWE = $3.10\text{E}12 \pm 2.68\%$ (Mo-99 gamma whole A)
- LLNL pending
- CIL pending



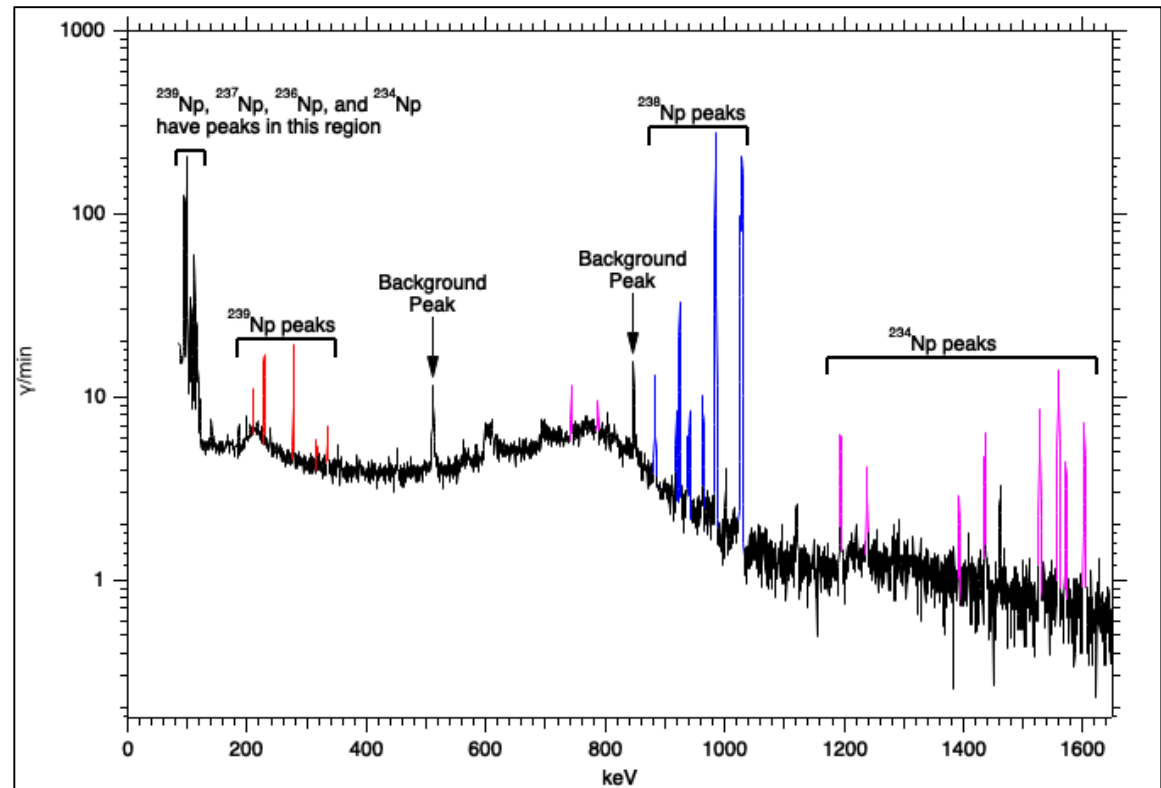
Fission product distributions for non-thermal sample



Laboratory	Measured ^{161}Tb R-value
LANL	$371 \pm 2.8\%$
PNNL	$383 \pm 3.8\%$

Unusual actinide isotopes measured

- In addition to ^{239}Np , ^{238}Np and ^{234}Np were measured by gamma spectrometry at LANL and PNNL.
- Alpha spectrometry indicated that ^{235}Np , ^{238}Pu , and ^{236}Pu were also present.

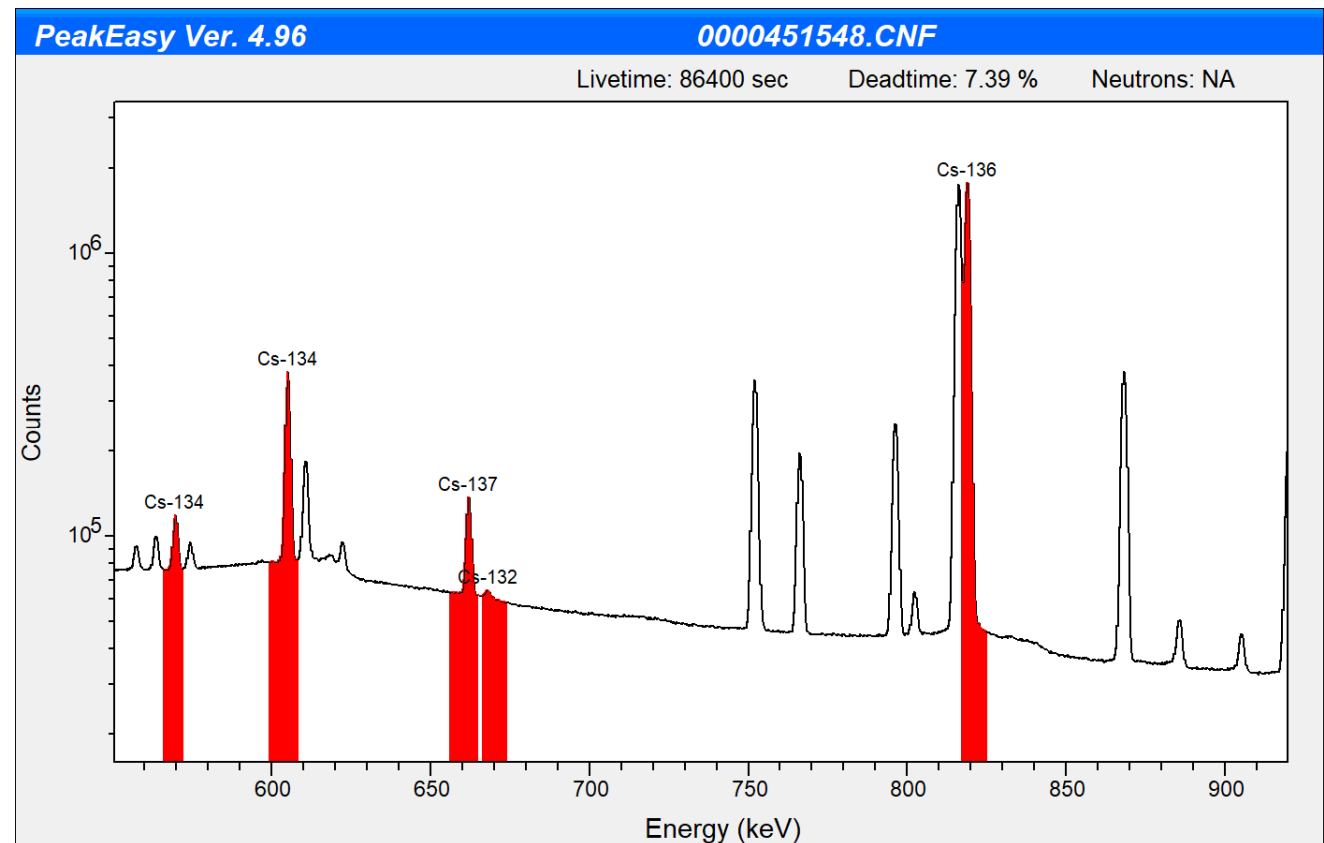


Unusual isotopes confirmed at multiple laboratories

Cs-132 @ 667.8 keV

Detected at both LANL
and PNNL

Production mode
unclear



Conclusions

- A successful inter-laboratory round robin in summer 2021, enabling comparison of fission product measurements in a non-thermal spectrum
- The experiment allowed each laboratory to measure the standard set of fission products and short-lived actinides, as well as many unique isotopes
- The extreme elevations in wing and valley isotopes exceed anything expected for a nuclear detonation
- Discussions to identify and plan more realistic future fission product exercises are planned